REMARKS

Initial remarks:

Applicant initially notes with appreciation the Examiner's indication in the December 2 Office Action that Claims 26-28, 34, 58-60 and 65 would be allowable if appropriately rewritten. In this regard, new Claims 66-68, 69, 70-72, and 73 include limitations included in dependent Claims 26-28, 34, 58-60 and 65, respectively, rewritten in independent form and are therefore believed to be in condition for allowance and such disposition is respectfully requested.

Drawing objections:

The Examiner has objected to the drawings under 37 C.F.R. 1.83(a) contending that first and second lever arms having different lengths are not shown in the drawings. Enclosed herewith is a proposed FIG. 1F and Applicant respectfully submits that in view of the proposed additional figure the objection to the drawings should be withdrawn. In this regard, among other features, the proposed additional figure illustrates the A-frame structures 40 (i.e. lever arms) of different length. Support for adding FIG. 1F to the drawings is included in the Summary section of the specification at page 6, lines 20-24, in the Detailed Description section of the specification at page 14, line 23 through page 15, line 2, and in claims 34 and 65.

Objections To The Specification

Applicant respectfully requests that the objections to specification be withdrawn in view of the amendments thereto.

Claim Objections

Applicant respectfully requests that the objections to Claims 27, 28, 59 and 60 be withdrawn as the antecedent basis issues noted by the Examiner are not present in Claims 27, 28, 59 and 60 as amended.

Claim rejections under 35 U.S.C. § 102 and/or 35 U.S.C. § 103:

In the December 2 Office Action, the Examiner rejected Claims 52-54 under 35 U.S.C. § 102(b) contending such claims are anticipated by United States Patent No. 5,870,007 to Carr et al. (Carr), rejected Claims 20-22, 24, 25, 29-33, 52-54, 56, 57, and 61-64 under 35 U.S.C. § 102(e)

contending that such claims are anticipated by U.S. Patent No. 6,366,414 to Aksyuk et al. (Aksyuk), and rejected Claims 23 and 55 under 35. U.S.C. § 103(a) contending that such Claims are obvious in view of Carr or Aksyuk.

Applicant respectfully disagrees that Carr and Aksyuk disclose Applicant's invention as set forth in each of independent Claims 20 and 52 as amended herein, and respectfully submits that independent Claims 20 and 52, and all claims depending directly or indirectly therefrom are in condition for allowance. As summarized more fully below, in each of independent Claims 20 and 52, the lever arms are pivoted to tilt the platform by mechanically coupling an actuation force thereto that is generated without utilizing any portion of the lever arms or platform to generate the actuation force. In this regard, the lever arms and/or platform of the microelectromechnaical systems of Claims 20 and 52 are essentially passive devices in the sense that the lever arms and/or platform are not electrically biased to generate the actuation force. However, as summarized more fully below, the cantilever arms or beams in both Carr and Aksyuk are active devices since an electrical bias or signal is applied to the cantilever arms or beams to flex or deflect the cantilever arms or beams to tilt their platforms.

More specifically, independent Claim 20 is directed to a microelectromechanical system comprising a substrate, a platform, a first lever arm, and a second lever arm. The platform includes first, second and third attachment points, with the platform being pivotably attached to the substrate at the first attachment point. The first lever arm is attached to the platform at the second attachment point of the platform and is pivotably attached to the substrate at a first anchor point on the substrate. The second lever arm is attached to the platform at the third attachment point of the platform and is pivotably attached to the substrate at a second anchor point on the substrate. The first attachment point is located on the same side of a line intersecting the second and third attachment points as a side of the line on which the first and second anchor points are located when the platform is in a non-tilted orientation with respect to the substrate. The first and second lever arms are separately pivotable about the first and second anchor points, respectively, by unequal angular amounts to tilt the platform with respect to the substrate with at least two degrees of freedom. Furthermore, each of the first and second lever arms are pivotable in response to an actuation force mechanically coupled thereto and generated without utilizing any portion of the lever arms and platform.

Independent Claim 52 is directed to a microelectromechanical system comprising a substrate, a platform, a first lever arm, and a second lever arm. The first lever arm is attached to the platform

by at least one compliant member and is pivotably attached to the substrate at a first anchor point on the substrate. The second lever arm is attached to the platform by at least one compliant member and is pivotably attached to the substrate at a second anchor point on the substrate. The first and second lever arms are pivotable about the first and second anchor points, respectively, in at least a first direction by equal angular amounts to tilt the platform with one degree of freedom in at least the first direction, and are pivotable about the first and second anchor points, respectively, in at least a first direction by unequal angular amounts to tilt the platform with respect to the substrate with at least two degrees of freedom. Furthermore, each of the first and second lever arms are pivotable in response to an actuation force mechanically coupled thereto and generated without utilizing any portion of the lever arms and platform.

Carr and Aksyuk do not disclose the microelectromechanical systems of independent Claims 20 and 52. Of particular significance is that both Carr and Aksyuk do not teach tilting of the platform with respect to the substrate by mechanically coupling an actuation force to lever arms, with the actuation force being generated without using any portion of the lever arms and platform. In this regard, in Carr, the cantilever arms 126, 128 that are used to effect elevation and tilting of platform 120 are each "comprised of a dual layer structure (such as described previously) to enable either heating or piezoelectric actuation thereof to cause each of the cantilever arms to flex and move the platform 120." (Carr Col. 7, lines 17-20). Such thermal or piezoelectric actuation necessarily requires application of an electrical bias or signal to the cantilever arms 126, 128 in order to generate the necessary force to flex the cantilever arms and thereby move the platform 120. Likewise, in Aksyuk "[a]fter the optical device is disposed above the plane of the substrate surface, the optical device moves relative to the plane of the substrate surface in response to an electrostatic field generated between the beams of the electro-mechanical structure and the substrate. The electrostatic field is generated by applying a bias voltage between the beams and the substrate." (Aksyuk, Col. 4, lines 37-43).

A number of advantages are achieved with the microelectromechanical systems of the present invention. One advantage is that the problem of electrostatic instability may be associated with using an electrical bias or signal in the cantilever arms or beams to generate the actuation force that flexes or deflects the cantilever arms or beams. Such problem is generally not present in the microelectromechanical systems of Claim 20 and 52 since no portion of the lever arms and platform are utilized to generate the actuation force that pivots the lever arms. In

this regard, the electrically biased cantilever arms and beams of Carr and Aksyuk and their respective substrates resemble parallel-plate capacitor-type electrostatic actuators. This is true as well for direct actuation of platforms supported by such beams or other spring elements. It has been recognized that in parallel-plate electrostatic actuators the problem of electrostatic instability or snap-down results when the voltage applied across the parallel plates exceeds a certain value; the moving plate uncontrollably accelerates until it is stabilized by a mechanical force (i.e., the moving plate "snaps-down" against the other plate). (See e.g., "Multiple Solutions in Electrostatic MEMS", a copy of which is included in the Supplemental IDS submitted herewith). In order to achieve the large displacements necessary for large tilt angles with the cantilever arms or beams of Carr and Aksyuk, large voltages will be required, thus introducing the possibility of electrostatic instability.

Based upon the foregoing, pending independent Claims 20 and 52, as well as their corresponding dependent claims are allowable over Carr and Aksyuk. There is therefore no need to separately address the patentability of each dependent claim and/or the Examiner's interpretation in relation to any of the dependent claims or any of the references of record in relation thereto.

Conclusion:

In view of the foregoing, Applicant believes that all pending claims are in condition for allowance and such disposition is respectfully requested. In the event that a telephone conversation would further prosecution, the Examiner is invited to contact the undersigned.

Respectfully submitted,

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